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P A P E R S

IN

C H E M I S T R Y.

The GOLD MEDAL of the Society was this Session voted to Mr. ISAAC JOPLING, of Gateshead, Durham, for Searching out and Working Quarries of British Marble. The following Communications were received from him, and the Specimens of the different Marbles are preserved in the Society's Repository, and are intended to decorate their Great Room.

SIR,

IN a letter of last June, from my good friend Mr. Charles Waistell, of High-Holborn, I received, inclosed, a List of Premiums offered by the Society for the Encouragement of Arts, Manufactures, and Commerce,—in pages 18 and 19 he had marked for my notice the Society's resolutions and regulations concerning specimens of British marbles. So far back as the year 1780 I began the business of marble-

mason here, at Gateshead, in the county of Durham, which I have carried on ever since with some degree of success. In the year 1758 I was informed by my marble merchant, who supplied me with foreign marble, that the French had got possession of Carrara, and that it was not likely that marble could be again imported into England from Italy for many years. As I had, from the writings of Camden, Knox, Pennant, Williams, and others, obtained a knowledge that there was white marble in Sutherlandshire, I made an agreement with the Countess of Sutherland, and the Earl Gower, for a lease of the marble quarries to be found in the county of Sutherland; and in May, 1799, I carried several Englishmen north, to search for marble. I spent seven summers and two winters in Assynt, a parish situated in the north-west corner of Sutherlandshire, not less than fifty miles from a market-town, where there had never been a road, a cart, or a smith who could shoe a horse. during which time I opened many quarries of marble, and made, at least, fourteen miles of road, through heretofore impassable mosses, bogs and rocks, to the sea. The difficulties and disadvantages I have laboured under were innumerable; meat, coals, iron, and every article were to fetch from such a great distance; and the people, "torpid with idleness," as Mr. Pennant expresses it in his Tour, and to which I refer for a description of this place, would do nothing for me without an exorbitant price, and never till it suited their own convenience; and from having no markets, and not being in the habit of selling, they could never be persuaded to part with any article at less than nearly double its worth. To help forward the road, I was, indeed, allowed the statute labor of the parish; but, after trying them awhile, so averse were they to work, that I refused to receive them, rather choosing to finish the road with my own men. The first
summer

summer was spent in trying and searching after quarries ; the second, third, and fourth was spent in making this road, which road Lord Reay passed about seven years ago, and last summer Mr. Anderson, a son of Dr. Anderson, who published the *Bee* ; each of these can tell what an arduous task it was to make a road in such a country ; and I believe they are both members of your's or the Royal Society. In 1806 I visited Ashford, in Derbyshire, to see the machinery there for sawing and polishing marble, and had a model made in London, like one which I saw that year in your rooms, said to be the model of a machine working at Torbay ; my intention was to have had such-like machinery erected near the quarries, and to have dwelt there, and superintended the works ; but not meeting with the encouragement which I needed from the proprietors, or rather from the manager of their estates, I did not afterwards return to Assynt, as I saw clearly it was only throwing away more money where I had already expended far too much for one individual to venture. I however still keep men at the quarries, and have since that time got one sloop load of marble brought away, and have another nearly ready, and have yet ten years of my lease unexpired. I have sent you a set of specimens, the produce of these quarries, and several other kinds of British marbles which I had by me. They are made 8 inches by 6, and 1 inch thick, except some that had been cut for veneers ; yet, nevertheless, I backed them to the thickness with stone, and sent them also ; they are as follows :—
No. 1. A white marble that will saw and work with a tool, but takes a bad polish. I sunk several yards deep in this quarry, but could not find it better. About ten years ago, I proposed this marble to A. Davison, Esq. for building the Naval Pillar then subscribing for, and he and I exchanged two or three letters upon the subject ; since that time I got

Mr. James Smith, who is now making Lord Nelson's monument, to carve a small head of this marble, which I believe is now in the possession of Mr. Atkinson, architect. This may prove a useful stone, but cannot be got in large blocks; and it has some narrow blue veins scattered through it. Nos. 2, 6, 8, 12, 14, and 16, are the produce of those quarries near No. 1; these all saw, work and polish easily, and can be got pretty large, and are all situated near half a mile up the sloping side of a hill. No. 4, is from a quarry close by, and under a small river, near half a mile from the former seven. In dry weather I have seen this marble bare six or seven yards by four or five, but it had all the appearance of being cracked. Although I have sent but one specimen of this kind, yet there is considerable diversity in the quarry, and it is compact, fine, and easy to work and polish, and is the very marble Williams described in his Mineral Kingdom, as pure white marble, fine as the Parian, and to be had of any size, without cracks or flaws, and situated under the bed of a small river, near a quarter of a mile from the house of Ardlock: this is exactly the situation; but for its being pure white, large, and solid, no doubt he fell into these errors by seeing its surface bleached by the weather, and making no further examination. I had people working here above a year, but never could get sound blocks of it large enough for chimney-hearths; no doubt larger blocks might be had by going deeper. I have seen some of this burnt to a very fine lime, and because it would make lime the inhabitants laughed heartily, to think a man should travel so far, and mistake his aim so much, as to take limestone for marble; for though they have a burn called in Gallic, *Aull na Marable*, (Marble River), they had no idea of marble when they saw it. No. 10, is got near a quarter
of

of a mile further down the river, and is very hard to saw, work and polish: this water is called Lyne, and the place Ledbeg, and I suppose it is fourteen miles from hence to the sea at Unapool, where there is a very safe natural harbour, where sloops may lie secure in any weather, and take in a cargo from the end of a rock which projects a little into the sea; the surface of this rock I levelled to serve as a pier, and to this place I made the road. Nos. 3, 5, 7, 9, 13 and 15, are from quarries at Coubin, a place upon the said road about seven miles from the sea: these marbles, with some others in their vicinity, I discovered entirely myself, as it was never supposed there was any marble there, and that at Ledbeg it was, by those who wrote, supposed to be white. When I showed this Coulin marble to workmen in London, and fell into conversation with them about it, they seemed all to think it unique: it is hard to work and polish, but beautiful, and when polished will retain it much better than softer marble; and I hope the public will rank these among the best foreign coloured marbles. All these sixteen are specimens of the quarries I have opened; there are several other kinds in the district, but not so well situated for bringing away. Of these marbles I have made many chimney-pieces, particularly for Donald M^cLeod, of Granus, Esq. Sheriff of Rossshire; Sir George Mackenzie, of Coul, Rossshire; Colonel Duff, of Fetteressoe, Aberdeenshire; Colonel Mitford, Exbury, near Southampton; and Admiral Sir Samuel Hood, London. I sent also several other chimney-pieces, made of it, to London, of which I believe the Duke of Athol got one to send to the Isle of Man, but for an account of the others, and of several that were made of it by workmen in London, I beg leave to refer to William Atkinson, Esq. Architect, No. 20, Bentinck-street, Cavendish-square, to whom I am much indebted for having re-

commended it. Nos. 17, 18, 19, 21, and 22, are varieties of serpentine from Portsoy, in Banffshire, which place I visited before I went to Assynt: this rock runs right into the sea, and I was of opinion that large blocks were not to be procured. In the middle of this serpentine runs a very coarse marble, a specimen of which I have sent, marked 20. No. 23, is a specimen of the Duke of Argyle's marble from the Isle of Tyrie; this is a beautiful marble, and I once, long ago, went from this place to Edinburgh on purpose to see a sloop load of it, but they would not sell it under three guineas and a half per solid foot, for which reason it never made its way into use. Nos. 24 and 25 are from Kilkenny, in Ireland; 26 from a place called Gallow-hill, 27 from Belsay-castle, both in Northumberland; this last belongs to Sir Charles Monk, and can be had sound almost any size. 28, 29, and 30, are from Frosterly in Weardale, in the county of Durham; these are taken from a thin stratum of the great limestone which stretches far through this county, and is to be seen both in Teasdale and Weardale. 31 and 32 are both from above Wearhead, but I believe cannot be got large, as far as I made trial; and no person knew of it, or ever attempted to work it but myself, about thirteen years ago. 33, 34, and 35, I suppose are from Devonshire. No. 36, Derbyshire-grey: this marble rises large in the bed, but so thin that they seldom get more than one slab out of one block, as I was informed by the proprietor of the marble-works at Ashford.

I am exceedingly sorry that I was so late in obtaining a knowledge, that the Society had a wish to encourage a search after British marbles: these specimens might have been produced ten years ago, and perhaps such a sale for this marble might have been promoted as would have reimbursed me for the expenses I have been at, the hardships I suffered

suffered in seven years personal attendance upon a search for marble, in such a country, where, from bad houses and a wet climate, I was seldom dry, day or night, except in fine weather, of which there is but little, and for the loss my own business has sustained here in my absence. To this account of expense, hardship and loss, I might add a little of vexation in having my tools broken, and frequently thrown into bogs; corn sown in my road; my oxen hunted before my face, for miles, with their dogs, and my grass eaten by their cattle for whole summers together. This sketch may show how anxious I have been to bring forward this marble, though only an individual, having no funds but the savings made from during twenty years a business not very extensive.

As I live in the north of England, and have quarries in the north of Scotland, if I can be of any use to the Society in helping to promote their views in regard to British marbles, I shall be happy to serve them; and if they think the Sutherland marbles worth encouragement, I hope they will endeavour to bring them into notice.

I am, Sir,

Your obedient Servant,

ISAAC JOPLING.

Gateshead, Feb. 17, 1810.

To C. TAYLOR, M. D. SEC.

Specimens

*Specimens of British Marbles sent to the Society, by Isaac Jopling, of Gateshead, Durham,
February, 1810.*

NUMBER.	COLOURS.	SITUATION AND QUALITY.	BY WHOM DISCOVERED.
1, -- -- -- 2, 6, 8, 12, 14, 16	White, Grey & White. }	The produce of four Quarries near each other, about half a mile up the sloping side of a hill. These all saw and polish easily except No. 1, and may be all got in pretty large blocks, except No. 1, situated in the Parish of Assynt, Sutherlandshire.	Supposed to have been known to travellers; but the Quarries were first opened by Mr. Jopling.
4, -- -- --	Light-grey:	Situated close by, and under a small river, near half a mile from the former seven specimens, a quarter of a mile from the house of Ardlock, Parish of Assynt, Sutherlandshire.	Described by Williams, in his Mineral Kingdom, as pure White, fine as Parian.
10, -- -- --	White, with small green and red veins.	Near a quarter of a mile farther down the river, very hard to saw, work, and polish. The river is called Lync, and the place Ledbeg, fourteen miles from hence to the sea, at Unapool, where there is a very safe, and natural harbour.	Quarry first opened by Mr. Jopling.
3, 5, 7, 9, 11, 13, 15	Variegated with red, brown, black, and white.	From Quarries at Coulin, a place upon the said road, seven miles from the sea.	Discovered by Mr. Jopling, not known before.

17, 18, 19, 21, 22	Red and Green.	Varieties of serpentine from Portsoy, in Banffshire.	
20, — — — —	White and Grey striped.	A vein in the middle of the above serpentine.	
23, — — — —	Pale Red, with black spots.	From the Island of Tyrie, belonging to the Duke of Argyle.	
24, 25, — — — —	Black, with white shells.	From Kilkenny, in Ireland.	
26, — — — —	Grey.	From a place called Gillow-hill, Northumberland.	
27, — — — —	Grey.	From Belsay Castle, Northumberland, belonging to Sir Charles Monk. The blocks may be got large, and it is easy to work.	
28, 29, 30, — —	Grey.	From Frosterly, in Weardale, in the County of Durham, the blocks large, and easy to work.	
31, 32, — — — —	Black and Grey.	From above Wearhead, in the County of Durham.	Discovered by Mr. Jopling thirteen years ago.
33, 34, 35, — —		From Devonshire.	
36, — — — —		Derbyshire-grey.	

The THANKS of the Society were this Session voted to the DUBLIN SOCIETY for various Specimens of Irish Marbles presented by them.

The THANKS of the Society were also voted to Lieutenant-General CHARLES VALLANCEY, Vice-President of that Society, for the following Communication on the subject. The Specimens of the Marbles are preserved, and are intended to decorate the Great Room of the Society.

SIR,

I HAVE this day sent to our ship-broker a box, containing twenty-nine specimens of Irish marbles for the Society of Arts, &c. and hope, in a short time, to forward some more ; they are, I am sorry to observe, chiefly procured from the tops of quarries, knocked off by our itinerant mineralogists.

From Kilkenny we have a beautiful madrapore, called by the stone-cutters *candle-drop*. The madrapore, in its natural state, (not petrified), is in our museum ; yet this beautiful marble is not wrought for sale, the owner of the common shell-marble having monopolized all the trade for chimney-pieces. The box will be forwarded to Liverpool to go by the canal to London, to your address.

I shall always be happy to execute any commands that the Society of Arts may be pleased to honor me with, and remain,

Sir,

Your most obedient humble Servant,

CHARLES VALLANCEY.

Dublin Society, Nov. 27, 1809.

TO C. TAYLOR, M. D. SEC.

*A List of Marbles found in the different Counties
of Ireland.*

ANTRIM.

- 1.—White limestone, found near Moira.
- 2.—Found near Moira and the Canal, running in beds and courses through No. 1.

CORK.

- 3 and 4.—Found near Killcrea, in large quarries.

DONNEGAL.

- 5.—Found at Gibbarow, near the sea-shore, and on the top of a rock. The estate of the Earl of Conyngham.
- 6.—Found in a little island near the shore, on the lands known by the name of Kilkenny. The estate of the Bishop of Raphoe.

DOWN.

- 7.—Found at Moira, in a similar situation as No. 2.

DUBLIN.

- 8.—Found at Porttranie, on the sea-shore, opposite Lambay island; a vein three feet thick, running through other rocks.
- 9, 10, and 11.—Found at Raheny, near Dublin, in quarries.

KILKENNY.

- 12 and 13.—Found at Kilkenny town, near the river Nore.
- 14 and 15.—Found near Kilkenny town, on the estate of the Earl of Ormond.

16.—Found at Ash-grove, and near the river Suir.

17.—Found at Besborough, in great abundance, and near water-carriage.

18.—Found at Killmacou, in very large blocks, and near water-carriage.

Note.—All the Kilkenny marbles are found in very extensive quarries.

KING'S COUNTY.

19.—Found near Tullamore and the Grand Canal, in a large quarry.

LONGFORD.

20 and 21.—Found at Ballymahon, on the banks of the river Shannon, and near the Royal Canal, in an inexhaustible quarry. The estate of the late Lord Oxmantown.

LIMERICK.

22.—A similar marble to this is found in large blocks on the banks of the river Shannon, opposite Fyan's Island, on the estate of the Earl of Conyngham.

TIPPERARY.

23.—Found in detached pieces at Glanboy, within eight miles of Clonmell, and near the river Suir. The estate of Sir Thomas Osborne.

24.—Found at Knockloftus, in a large quarry, near the river Suir. The estate of Lord Donoughmore.

WATERFORD.

25 and 26.—Found in large masses on the sea-shore, near Dungarvon. The estate of Arthur M'Guire, Esq.

27.—Found on cliffs extending along the shore of the harbour of Bolton. The estate of Cornelius Bolton, Esq.

FERMANAGH.

28 and 29.—Resemble marble found near Florence-court and Lough-erne, at an arch formed by the river, on the estate of the Earl of Inniskillen.

The THANKS of the Society, were this Session voted to ALEXANDER MITCHELL, Esq. of St. Alban's-street, for his Present of various Specimens of Granite and other Minerals, which are preserved in the Society's Repository.

DEAR SIR,

I SEND you, by the bearer, some specimens of minerals, as granites, from Aberdeenshire, and other articles, the particulars of which are given in the inclosed letter from my friend Mr. Ewens. I am sorry that I did not know the size of the specimens required by the Society when I first wrote for them; I hope however they will be thought worthy of the Society's attention.

I am, your's very truly,

A. MITCHELL.

No. 8, St. Alban's-street, Jan 10, 1810.

TO C. TAYLOR, M. D. SEC.

Extract

*Extract of a Letter, dated Aberdeen, Dec. 26, 1809,
from John Ewen, Esq. to A. Mitchell, Esq. St.
Alban's-street, London.*

“ I HAD given an order for some specimens of our country granite, before I received the favor of your last letter, and indeed they were in the progress of polishing their faces before the letter reached me. Of course the sizes are smaller than those you mention, but on another occasion I shall attend to your instructions, and procure the specimens of the size you mention; in the mean time please to accept the following :—

No.

1. A specimen of Granite, from Logie, near Inverary.
2. A ditto ditto, — Hilton, near Aberdeen.
3. A ditto ditto, — Skene, ditto.
4. A ditto ditto, — Peterhead.
5. A ditto ditto, — Rubislaw, near Aberdeen.
6. A ditto ditto, — Lonehead, ditto.
7. A ditto ditto, — Dancincaern, ditto.
8. A ditto Porphyry, — Portsoy, Banffshire.
9. A ditto ditto, — Labradore.

“ We abound here in granite, and, in the upper district of the county, beautiful specimens of the Amianthus; the Asbestos of Pliny, are in great variety. The Cairngoram, as is improperly called, from that species of crystal having been first noticed in the neighbourhood of that mountain, near the source of the Spey, is found in most of the upper districts of Aberdeenshire. I have myself one of these hexagonal prism crystals, found near the source of the Dee, which weighs one hundred and forty-eight ounces, and is,
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in its largest circumference one foot seven inches. We are deficient in marbles, for the best specimens of these are to be found in the Western Highlands, and in the Hebrides.

I got last year one specimen of the Scotch topaz from the neighbourhood of Bennachie, in the district of Garioch, as fine a yellow as I ever saw from the Brazils; the most predominating tinge however of these crystals is the brown, or brandy colour.

The SILVER MEDAL of the Society was this Session voted to MR. B. COOK, of Birmingham, for his Method of producing Heat, Light, and various useful Articles, from Pit-coal. The following Communications were received from him, and Specimens of the Petroleum, Asphaltum, and other Products, and a Waiter varnished therewith, are preserved in the Society's Repository.

SIR,

HAVING paid much attention to the procuring of gas, and other products, from pit coal, I now beg leave to lay before the Society for the Encouragement of Arts, &c. the results of some of my experiments on pit-coal, and the methods of procuring the sundry articles of which I have sent samples, and a japanned waiter varnished therewith. The quantity of clear tar which may be produced from every hundred weight of coal is about four pounds, from which a liquor, or volatile oil, may be distilled, which answers the purposes

of oil of turpentine in japanning. Every gallon of tar will produce nearly two quarts of this oil by distillation, and a residuum will be left nearly, if not quite equal, to the best asphaltum. I have sent a waiter, or hand-board, japanned with varnish made from this residuum, and the volatile oil above mentioned. This dries sooner, and will be found to answer as well as the best oil of turpentine, a circumstance which will be of immense advantage to this country, as in the vicinity of Birmingham only, nearly ten thousand tons of pit-coal are coked or charred per week; and all the tar hitherto been lost; but by my process, I dare venture to say, that from the various coal works in this kingdom, more tar might be produced than would supply all our dock-yards, boat-builders, and other trades, with tar and pitch, besides furnishing a substitute for all the oil of turpentine and asphaltum used in the kingdom, and improving the coke so as to make iron with less charcoal.

I have sent a large specimen of the asphaltum, and three vial bottles containing as follows:—

No. 1.—A sample of the oil or spirit, being part of that which was used in making the varnish with which the waiter sent was japanned.

No. 2.—Is the same oil or spirit, a little more rectified.

No. 3.—The same, still further rectified, and of course more clear, and freer from smell; but I find that the specimen, No. 1, answers quite as well for varnish.

Tar-spirit is now about 8s. per gallon, and turpentine-spirit about 15s., this latter has been, within the last two years, as high as 48s. per gallon, and the tar-spirit will answer equally as well for varnish, as you will observe by the inclosed Certificate from Mr. Le Resche, on using the coal-tar-spirit, instead of the turpentine spirit.

I requested Mr. Le Resche to use the tar-spirit just in
the

the same way he would the foreign spirit, and then give the varnish to his work-people to use, without making any remark to them, which was done: he, making the varnish himself, found it mixed, and made the varnish as good in appearance as that prepared with the foreign spirit. He then gave the varnish to his work-people to use, and when they had finished their work with it, he found from their report, that it answered perfectly, and dried sooner; and when the waiter done with it was given to the polisher, it was found to polish much smoother under the hand, and take a more beautiful gloss than their former varnish, as the article now sent will shew on inspection.

I am of opinion that the production of these articles will be of great public service. Permit me to add, that the timber of ships paid with this tar is not nearly so liable to be worm-eaten as those done with common tar.

I remain, Sir,

Your humble Servant,

B. COOK.

Birmingham, Jan. 12, 1810.

To C. TAYLOR, M. D. SEC.

The following CERTIFICATE was received from Mr. LE RESCHE, who prepared and applied the Varnish of the Waiter sent to the Society.

This is to certify, that the spirit or oil, extracted from coal-tar, is every way adequate to the purpose for which it is intended, as a substitute for the foreign spirit or oil used in japanning.

Mr. Cook having desired me to make a trial of it, the tray, or waiter, accompanying this paper, was got up in my manufactory, and is a specimen in proof of its usefulness. The varnish used for that purpose I made myself, and instead of mixing it with the usual spirit or oil imported, which is now become excessively dear, I mixed it with the spirit, or oil, extracted from coal-tar; and as I can truly affirm, that far from its being a substitute inferior in properties to the spirit in general use, I esteem it far superior in several respects.

In the trial I made of it, I found it would dry quicker, and the varnish mixed with it would polish with more ease, bear a good lustre, and, in short, answer every requisite purpose of the foreign spirit. If to these be added the reasonable price at which it may be sold, I cannot but pronounce it a discovery that must eventually prove greatly advantageous to the manufacturer, as well as interesting to every lover of the arts, or admirer of talent and ingenuity.

Witness my hand, the 16th day of January, 1810,

J. S. LE RESCH, Japanner,
Church-street, Birmingham.

*Reference to Mr. Cook's Apparatus for preparing Gas
and other Products from Pit-Coal, Pl. 3.*

A, Fig. 1, Pl. 3, is a common fire-place, a stove built with brick, having cast-iron bars to put the fire in at, and a flue that goes into a chimney; A is the cast iron pot, (which holds from twenty-five pound to one hundred pound of coal, according to the size of the premises to be lighted)
which

which hangs by the bewels or ears on a hook, suspended by a chain in this stove or furnace, about three inches above the bars of the grate, and three inches distant from the sides of the stove ; the fire then flames all round this pot, and as it does not rest on the burning fuel, it is the flame only that heats it, so that it does not scale, but will last for years. The smoke, &c. is carried off into a chimney. The cover *d* of the pot is made rather conical, to fit into the top of the pot close, and from the top of the cover the elbow-pipe proceeds as far as the mark *a*. The other end of the pipe with the elbow entering the water-joint is rivetted to it after ; when the lid or cover of the pot is put on, the bewels or ears come over the elbow of the pipe that is on the lid, and a wedge is put between them and this elbow, to keep down the cover air-tight, and a little clay or loam may be luted in the joint, if any gas should escape round the cover of the pot. The other elbow *B* goes into a water-joint, formed of a tube affixed to the cover of the purifier *C* ; and another tube, which passes through the lid of the purifier : the elbow-pipe then goes over the inner tube, and when put on, the jointing is made good by pouring water into the space between the tubes, which renders it air-tight. The gas, as the arrows shew, passes down into the purifier *C*, which is rather more than half full of water ; the use of this water-joint is for the convenience of removing the lid *d*, to which this pipe is attached. The purifier *C* is a wooden trough, with a sheet-iron top, to which the tubes are soldered, and it is fastened to the trough to keep all secure and air-tight. The sheets of iron, *e, f, g, h, i, k*, are alternately soldered to the iron top, and fastened to the wooden bottom. Now when the trough is half filled with water, the gas passes into it at *B*, and as it can only find its way out again at *R*, it must pass through the water. The inner pipe *B* reaches

under the surface of the water in the trough; now when the gas is forced into the water, it would rise to the top of the purifier, and go along in a body to the end, and out at the pipe R, if the sheets of iron, *e*, *f*, *g*, *h*, *i*, and *k*, which stand across the trough with openings in them, alternately at top and bottom, did not stop it, force it to descend down into the water, and hinder it from going any way but through these apertures, purifying it all the time it is passing through the whole body of water, until it is properly washed; it then escapes through the pipe R at the end of the trough C, then passes down the pipe S, and is carried up into the reservoir or gazometer K. In the bottom of the purifier is an aperture, closed by a plug at D, to let off the ammoniacal water and tar as it is deposited, and the pipe, with the cock E at the top of the purifier, is to burn away the spare gas when not to be used.

There is a stop-cock placed in the main pipe at F, that when the reservoir is full, and gas is making, and cannot be used, the cock may be turned, and prevent any gas from passing from the reservoir, and by opening the cock E on the top of the purifier, and firing it, all the gas which is made more than is wanted for use may be burnt away. If this was not done, the gas would continue to find its way into the reservoir K, which would overflow, and produce a disagreeable smell, which this simple way of burning it away as fast as it is made when not wanted, prevents.

It may in some measure happen, that although the gas has passed through the purifier C, yet that a small portion of tar will pass along with it, and would either clog the pipe S, or accumulate in the reservoir. To avoid this, there is placed at the bottom of the pipe S at G, before it rises into the reservoir, a jar into which a pipe made, as shewn in the drawing, conducts the tar; this collects all that passes through

through the purifier ; it is filled with water, over which the gas passes up into the reservoir, but the tar drains down this lead pipe and deposits itself in the jar of water. The longer this pipe S is, the better, as it serves as a refrigitory. H is a plain cask, made to any proper size, and filled with water, with a cock to draw off the water when it becomes foul. The upper vessel K is made of sheet iron, rivetted together in the manner engine-boilers are made. If it is only from five hundred to one thousand gallons in size, it will require only two cross iron bars at top, and four ribs down the sides to keep it in form, with a strong ring at top ; and as there is no stress on this vessel, it will ascend and descend easily without any other support or framing, the plain sheet iron sides being rivetted to the four ribs, and it is quite open at the bottom. A strong rope runs over the pullies L L, with a weight M to balance the vessel K, and assist it in rising and falling. The pipe J is that through which the gas passes from the reservoir or gazometer, and rising through the pipe T, is conveyed to all parts to be lighted. There is also another drain-pipe at N, for after all the washing, &c. a very small portion of tar and moisture may rise into the pipes, and perhaps in time clog them, but by laying all the pipes in the first, second, and third stories on a small descent, if any tar or moisture should rise, it will drain down all the pipes from top to bottom, and be deposited in the earthen jar at N, by that means the pipes will not clog up in half a century. These jars must be sometimes removed and emptied, fresh water put in, as also the water in the vessel H must be changed, to keep it clean and sweet ; and the water in the purifier C should be changed every two or three days : by these means the gas will be deprived of all its smell, at least as far as washing will effect it, and the apparatus will be clean.

The stop-cock at O is for the use of a master, if he wishes to lock up the gas in the reservoir, to prevent his workman, &c. wasting it in his absence, as also if any pipe should leak, or a cock be out of order, in any part of the premises, by turning this cock all the gas is kept in the reservoir while the pipe is repaired, or any other alteration made; it also extinguishes all the lights when turned, if any are left burning by careless workmen, nor can they be lighted until it is opened again.

The whole of this apparatus is simple, and not liable to be put out of order in such a way, but that any person may put it to rights again. All the art required to make the gas is to take off the cover of the pot, and without removing the pot to take out the coke, and fill it with fresh coal, wedge it down by putting an iron wedge between the bewels or ears and the elbow of the vessel, and if required, plaster a little clay or loam round the cover, to keep it air-tight, a fire is then made under it, and the whole is done. The boy or man who does it, must now and then look at the fire and keep it up, until the pot is hot, and the gas is made. Now in works where lights are wanted almost always, I would recommend two fire-places, and two pots, so that when one pot is burned out, the other pot may be ready to act; for this purpose the purifier must be provided with two of the water-joints B, one communicating with each pot, and the elbow-pipe of each pot must have a stop-cock, as V: now when one pot is burning, the cock in the other pipe must be stopped, that the gas may not find its way out of the purifier, and when all the gas is extracted from that pot, the cock C, leading from it, must be stopped, and the pot left to cool; while a fire is put under the other pot, its cock is opened, and a supply of gas from it is passed into the reservoir; by these means one of the pots is constantly supplying the reservoir with gas, and the lights
are

are always kept burning; one purifier is all that is necessary; the cock V must be shut when either of the covers are taken up to fill the pot again with coal; when the elbow-pipe is lifted out of the water-joint, as the cover is attached to it, a plug must be provided to fit into the water-joint pipe the moment the elbow is removed from it, or the gas will rush out of the pipe at the water-joint; but a better way would be, to lengthen the pipe of the water-joints B, and place a large cock under each of them, almost close to the top of the purifier; when one pot is burnt out by turning the cock it keeps all the gas in the purifier while the cover is removed: no plug is necessary in this method. When people are very particular, (especially when houses or accompting-houses are to be lighted), and wish all smell to be destroyed, if they are not satisfied with washing it, and still think there is a little smell left, (and very little indeed, if any, will be left), after the washing, a small trough may be added, made in the same way as the purifier, with sheets of iron across to force the gas through the pipe R communicating with it. This trough may be filled with water, with a few lumps of lime put into it, and this water and lime changed often; on the gas being forced through this lime-water, if there was any remaining smell in it, this would completely take it away, and, as has been before observed, by changing all the waters now and then, and keeping this small trough constantly supplied with clean water and lime, the gas after passing it will ascend the pipes to the lights pure.

SIR,

HAVING been from home, I was prevented from answering your obliging letter until this day.—I am much pleased that the Society have approved of my specimens produced
from

from pit-coal. I also feel highly gratified and honored with their Reward. I hope to lay before you, in a short time, an account of the establishment of a work that will be of such magnitude, as will supply this part of the country with the oil or spirit, in sufficient quantity to supersede the use of turpentine, &c. in japanning; and I do hope that in time works of the same description will be established through all Staffordshire, whose products will supply the place of a great portion of the spirit used in the kingdom, while the pitch will be of sufficient quantity to form a great part of that article now used in the dock-yards.

All I want is support from the great coal companies and masters, to erect sufficient apparatus at the different works to preserve the tar at all the coke furnaces, and proper means to separate the spirit from the tar. It would be a great saving to the nation, as in every one hundred and twelve pound of coal coked, there is lost by the present mode about four pound of tar, and the cokes are not half so good as if they were coked in close vessels, to the exclusion of the atmospheric air. I need not describe the method by drawings of the manner of extracting the tar from pit-coal in close vessels, as that method is so generally known; it must be clear to every one, that it is procured by distilling the coal.

I have, as follows, described the method I use in extracting the spirit from the tar, the process of which is so simple that every one must understand it.

Fig. 2, Pl. 3, is a section of the furnaces, and one of the retorts, almost any number of which may work in a line, the same flue will do for all, only taking care, if any are not at work, to stop up the draught-hole, which communicates with the flue. These furnaces are built without bars, grates, or doors. A is the place where the fuel is put in

to

Mr. Cooke's apparatus for making gas, & other products from Bit Coal.

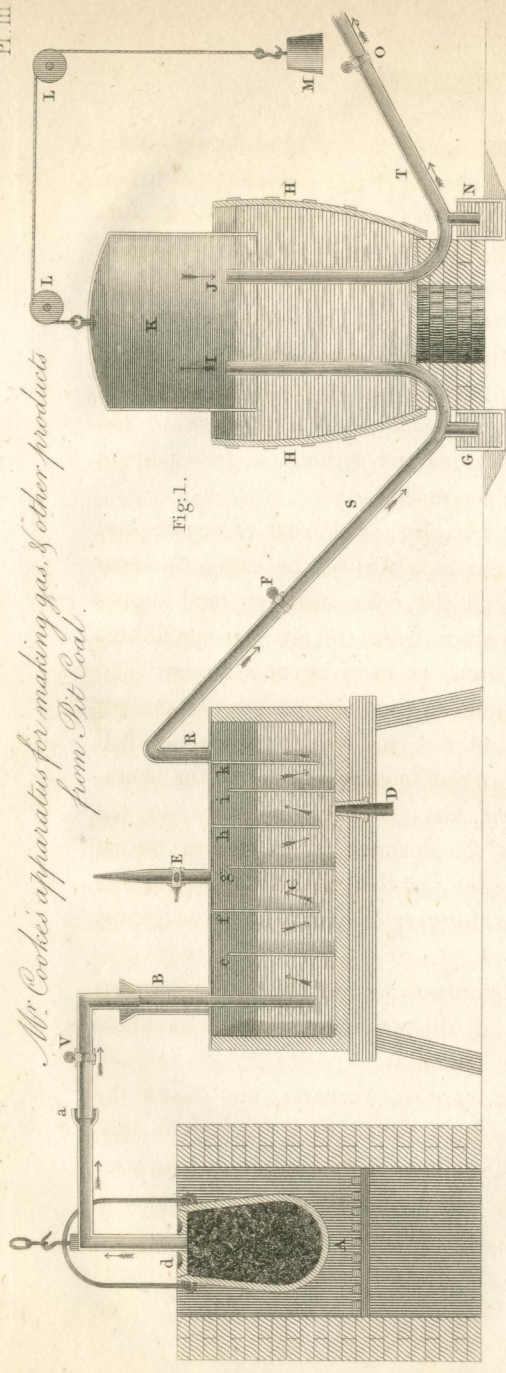


Fig. 1.

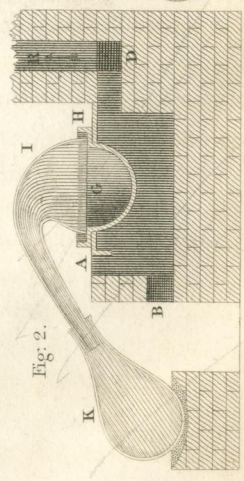


Fig. 2.

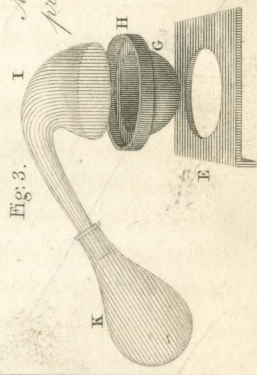


Fig. 3.

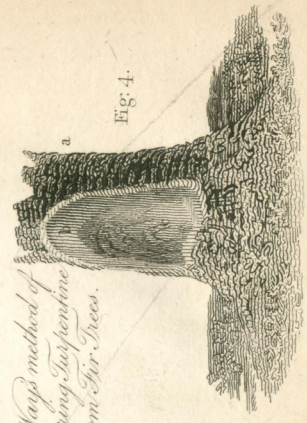


Fig. 4.

Mr. Wray's method of procuring Turpentine from Fir Trees.

to heat the retort G, the fire lies under it, and the smoke is carried off into the flue F. B is the aperture where the ashes are raked out. G is a section of the iron bason, or lower part of the retort; the dark-shaded square part shows the space the fire occupies, and the black square D the flue as it runs along the back of all the line of furnaces, and enters the chimney R, as the arrows shew. I, Figs. 2 and 3, shews the upper part of the iron, earthen, or glass retort, fitted on the cast-iron bason G. K, the receiver. By this mode of setting the retorts, all the great expense of bars, doors, frames, &c. are saved, and a brisker draught of air is obtained, which may be slackened at pleasure by covering up in part, or wholly, the fire-place A with a brick. E is a square iron plate with a circular hole in the centre, built on the top of the furnace. The cast-iron bason of the retort G is made to the size of the hole in the plate: the most convenient size of the bason of the retort I find is about five or six gallons, in the shape of a deep pot, with a flanch or rim H round the edge of it; this pot or bason of the retort is put into the iron plate E, and the flanch of the retort then rests on the plate E. I is the upper part of the retort without a bottom, made to rest and fit on the flanch of the cast-iron bason G. K is the receiver, larger in the mouth than the nose of the retort. To begin the work, I fill, nearly, the iron bason of the retort G with coal-tar. I then put on the upper part of the retort I, and make it air-tight with a little sand thrown round it at the flanch H; the receiver K is put in its place, and a slow fire is put in at A, under the retort; the tar soon begins to boil slowly, or rather simmer; now as soon as that begins there rises from the tar a thick whitish vapour, which fills the glass retort, part becomes condensed, and falls

falls in drops from the sides of the retort into the tar again, while the purer spirit rises into the neck is condensed, and keeps dripping down the neck into the receiver ; this is the spirit of the tar, and with this spirit that first arises from the tar was the waiter japanned which I sent you. The reason I chose to have the receiver wider at the mouth considerably than the nose of the retort is, that there is a strong and very volatile oily ammonia, that does not soon condense, but gets out of the receiver into the air the instant it leaves the retort, and though but in a very small quantity, so small that it is hardly possible to catch it ; yet will it impregnate the air for a great distance round, with its very penetrating smell, while the spirit keeps dropping into the receiver pure and separate from the ammonia. The spirit is very volatile, quite as much so, if not more, than the spirit of turpentine, and soon evaporates if exposed to the air, which is a proof of its drying nature ; indeed when used as a substitute for turpentine, it dries in the stove quite as soon or sooner, and takes equally as beautiful a polish. I sent you three specimens, No. 1. is what came off the tar first. No. 2. is the same distilled a second time ; and the third specimen is the second re-distilled again in a glass retort : it there leaves a little pitchy residuum, and comes over clear, as the sample. Very little of the spirit is lost in passing through these different stages, if care is taken that the fire is slow and the process not hurried. When the spirit is perfectly extracted from the tar, there remains in the bason of the retort that beautiful pitch or asphaltum sent, which when mixed with the spirit, forms an ingredient for making the black varnish used in japanning. If it is wished to use it as pitch, less spirit must not be extracted from it. I find that six
gallons

gallons of tar will produce, if care is taken, about two gallons or two gallons and a half of spirit. A great number of retorts may be kept working by a single man ; if we say only one hundred, and only worked down in a day, they will produce two hundred to two hundred and fifty gallons of spirit, so that by increasing the number, any quantity may be obtained. When the spirit is used in the place of turpentine, the varnish-maker uses it in the same way, and in the same quantity, as there appears no manner of difference in the use of it from spirit of turpentine in the making of varnish. When the asphaltum is used, it supplies the place of real asphaltum, and in about the same quantity. I have explained the whole as clear as I can, but if any more information is required, I should feel happy in giving it, and am,

Sir,

With great respect,

Your obedient humble Servant,

B. COOK.

Birmingham, March 13, 1810.

To C. TAYLOR, M. D. SEC.

* * To such persons as wish for further particulars on the subject of lighting apartments with gas, it may be proper to note that the Society, in their 26th volume of Transactions, page 202, have given an engraving and description of a gazometer, and apparatus for making carbonated hydrogen gas from pit coal, which communication was sent to them by Mr. S. CLEGG, of Manchester.

The

The SILVER MEDAL of the Society was this Session voted to Mr. H. B. WAY, of Bridport Harbour, for his Method of procuring Turpentine and other Products from the Scotch Fir, (Pinus Silvestris, Linn.). The following Communication was received from him, an Explanatory Engraving is annexed, and part of the Tree, from whence the Turpentine was extracted, along with some of the Products, are preserved in the Society's Repository.

SIR,

THE enormous high price of turpentine, tar and pitch, last year, brought to my remembrance that I had, in 1792, when in America, made some memorandums on the subject of obtaining them in North Carolina, which, on referring to, led me to think that they might be obtained in this country. I was induced to mention it to my relation and friend, John Herbert Brown, Esq. of Weymouth, and of Sheen, in Middlesex, when on a visit at my house, and I expressed a wish that I could try the experiment with regard to turpentine, when he very kindly gave me leave to try it on three trees growing on his estate, about three or four miles from this place, and he went with me and fixed on them, and early in last April I had them prepared for the purpose of extracting the turpentine, and they have been running till the 18th instant. The weather, except the last month and part of this, has, from so much rain falling, and there being so little hot weather, been particularly unfavorable for this business, as the distance
being

being such as to prevent the trees being regularly attended, the hollows were frequently found by my men full of water, and a good deal of the turpentine, which run off with the water, lay on the ground. Under all these circumstances I was only able to obtain from the three trees about two pounds and a half of turpentine. Mr. Brown being with me again the 16th and 17th instant, as he wished to take the trees down, I begged he would allow me to take a part from one of them, for the purpose of sending to the Society of Arts, Manufactures, and Commerce, with the turpentine collected from the trees, which he most readily complied with. I have therefore taken about six feet from one of them, (they were all nearly the same size); what I have sent is the part from the ground to the top of the place that has been cut away for the turpentine to run into the hollow, from whence it was to be collected; the hollow was cut in this considerably higher than is usual in America, as this tree stood in a hedge, and could not well be hollowed lower; I have matted up this part of the tree, and secured it with straw and a double matt, to prevent the bark being rubbed off, that it may be seen in the same state as it stood when the turpentine was taken from it; the turpentine is in the cask in which it was deposited when brought from the trees, and I have this day shipped both on board the sloop Betsey, Captain Trent, bound to Downe's Wharf, London, directed to you, freight paid here by me, which vessel I expect will sail in a day or two, and I hope you will receive them safe, which, when you do, you will much oblige me by requesting that both may be examined, in the hope that this small trial may meet with the approbation of the very highly respectable and truly useful Society of Arts, Manufactures, and Commerce, and if considered likely to prove useful, that they may induce some person

person who has the means and opportunity of doing it, to make a trial on a larger scale, so as to fairly ascertain whether turpentine can be obtained in this country from the very large and numerous plantations of Scotch firs, now in the United Kingdom, previous to the trees being cut down, either to thin plantations, or where ground is designed to be cleared, as taking the turpentine from the trees previous to their being cut does not at all injure the wood, and by making the hollow in the trunk of the tree about six inches from the ground, it would waste but a very small quantity of timber. I have taken the liberty of annexing a copy of memorandums I made when in North Carolina, respecting the modes of collecting turpentine, and making tar and pitch, in hopes they may afford the Society some little information, as they are not, I apprehend, very generally known. They are copied from memorandums which I actually made on the spot. I would have sent the memorandum-books with this, had not the remarks been mingled with others relative to my commercial pursuits, but I shall have no hesitation in allowing any person to examine them, or to afford any information in my power to any persons willing to make experiments in this way, if they will favor me with a call. I am well satisfied in my own mind, that very large quantities of tar might be obtained from the knots and limbs of the Scotch fir when cut down, and that the charcoal made from it would not be injured by the tar being first extracted; and as I was in Norway, Sweden, and Russia, in 1789 and 1790, and saw no tree from which I consider that tar could be extracted, except the Scotch fir, or red deal, which is one and the same tree, I am persuaded that the refuse of that tree must be what they make the tar from in those countries, though I had no opportunity of seeing the process there. I suspect that the
Swedish

Swedish tar-kilns must be constructed of brick, or some sort of masonry, as the tar from thence is much clearer, better, and more free from extraneous matters than that of any other country. I have observed the tar from North Carolina to have frequently a quantity of sand in it, which is easily accounted for, from the soil in which the kilns are made; it would, in the careless way in which they take it out of the hole dug in a sandy soil, be very likely to be mixed with the sand. In the small cask, in which the turpentine is, I have sent a few small red deal knots from some timber that I have lately taken out of my warehouse, on some alterations being made; the timber from which they are taken has been in the warehouse ever since the summer of 1786, and yet when these pieces are exposed to a moderate heat, the tar will be seen to exude from them.

I remain, Sir,

Your obedient and very humble Servant,

H. B. WAY.

Bridport Harbour, Nov. 27, 1809.

To C. TAYLOR, M. D. SEC.

Extracts from Notes taken by Mr. Way.

Thursday, April 12, 1792.

ARRIVED at Wilmington, North Carolina, about one P. M. Observed on the roads the pitch-pines prepared for extracting turpentine, which is done by cutting a hollow in the tree about six inches from the ground, and then taking the bark off from a space of about eighteen inches above it, from the sappy wood. The turpentine runs from April to October, and is caught by the hollow below. Some of the

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trees

trees were cut on two sides, and only a strip of the bark left of about four inches in breadth on each of the other two sides, for conveyance of the sap necessary for the support of the tree. A Captain Cook, with whom I had been travelling, informed me that some trees would run six or seven years, and that every year the bark was cut away higher and higher, till the tree would run no longer, and I observed many that had done running, and they were in general stripped of the bark on two sides, as high as a man could reach, and some were dead from the operation; others did not look much the worse for it. I find the usual task is for one man to attend three thousand trees, which taken together would produce one hundred to one hundred and ten barrels of turpentine.

April 15, 1792.

ON my return from Wilmington to Cowen's tavern, distant about sixteen miles from thence, I was informed that the master of the house had been a superintendant of negroes, who collected turpentine. I found the information I had before received was not perfectly correct; he told me he attended to six slaves for a year for a planter, and between the 1st of April and the 1st of September they made six hundred barrels of turpentine. The cutting the trees for the purpose of collecting is called boxing them, and it is reckoned a good day's work to box sixty in a day; the trees will not run longer than four years, and it is necessary to take off a thin piece of the wood about once a week, and also as often as it rains, as that stops the trees running. While in North Carolina, I was particular in my inquiries respecting the making tar and pitch, and I saw several tar-kilns; they have two sorts of wood that they make it from, both of which are the pitch-pine; the sort from which most of it is made are old trees which have fallen down in the woods,
and

and the sap rotted off, and is what they call light-wood, not from the weight of it, as it is very heavy, but from its combustile nature, as it will light with a candle, and a piece of it thrown into the fire will give light enough to read and write by ; all the pitch-pine will not become light-wood ; the people concerned in making tar know it from the appearance of the turpentine in the grain of the wood, the other sort of wood which is used, after the trees which have been boxed for turpentine, have done running, they split off the faces over which the turpentine has run, and of this wood is made what is called green-tar, being made from green-wood instead of dry. When a sufficient quantity of wood is got together, the first step is to fix a stake in the ground, to which they fasten a string, and from the stake, as a centre, they describe a circle on the ground according to the size they wish to have the kiln ; they consider that one, twenty feet in diameter and fourteen feet high, should produce them two hundred barrels of tar ; they then dig out all the earth a spit deep, shelving inwards within the circle, and sloping to the centre ; the earth taken out is thrown up in a bank about one foot and half high round the edge of the circle ; they next get a pine that will split strait, of a sufficient length to reach from the centre of the circle someway beyond the bank ; this pine is split through the middle, and both parts are then hollowed out, after which they are put together, and sunk in such a way, that one end, which is placed in the centre of the circle is higher than that end which comes without the bank, where a hole is dug in the ground for the tar to run into, and whence the tar is taken up and barrelled as it runs from the kiln. After the kiln is marked out, they bring the wood, ready split up, in small billets, rather smaller than are generally used for the fires in England, and it is

then packed as close as possible, with the end inwards, sloping towards the middle, and the middle is filled up with small wood and the knots of trees, which last have more tar in them than any other part of the wood; the kiln is built in such a way, that at twelve or fourteen feet high it will overhang two or three feet, and it appears quite compact and solid. After the whole of the wood is piled on, they get a parcel of small logs, and then place a line of turf, then another line of logs, and so on alternately all the way up, and the top they cover with two or three thicknesses of turf. After the whole is covered in this way, they take out a turf in ten or a dozen different places round the top, at each of which they light it, and it then burns downwards till the whole of the tar is melted out; and if it burns too fast they stop some of the holes, and if not fast enough they open others, all of which the tar-burner, from practice, is able to judge of. When it begins to run slow, if it is near where charcoal is wanted, they fill up all the holes, and watch it to prevent the fire breaking out any where till the whole is charred; the charcoal is worth two-pence to three-pence, British sterling, per bushel. It will take six or eight days to burn a tar-kiln; in some places they burn it at such a distance from the shipping that they have very far to roll it, and even then sell it at from 3*s.* 6*d.* to 5*s.* British sterling, per barrel, sometimes taking the whole out in goods, but never less than half the amount in goods, from all which it will be reasonably supposed that tar-burning in that country is but a bad trade, as it must be a good hand to make more than at the rate of a barrel a day; the barrels cost the burner about 1*s.* 3*d.* British sterling, each; the tar-makers are in general very poor, except here and there one that has an opportunity of making it near the water-side. Pitch is made by either boiling the tar till it comes to a proper thickness,

thickness, or else by burning it; the latter is done by digging a hole in the ground, and lining it with brick, it is then filled with tar, and they set fire to it, and allow it to burn till they judge it has burnt enough, which is known by dipping a stick into it, and letting it cool; when burnt enough they put a cover over it, which stops it close, and puts out the fire. Five barrels of green tar will make two of pitch; and it will take two barrels of other tar to make one of pitch.

N. B.—The foregoing observations respecting tar and pitch, are copied from a memorandum made by me at Suffolk, in Virginia, on the borders of North Carolina, April 23, 1792, and are the result of the inquiries and observations I made on the subject whilst in Carolina.

Wilmington, N. C. April 13, 1792.

IN conversation with a Mr. Hogg, who had been settled there, and at Fayette-ville before the War, I learnt that pitch-pine timber growing on the sands was the best, and that it was reckoned to be better if cut in the winter before the sap rises in the tree.

H. B. WAY.

SIR,

IT affords me much pleasure to learn that my communication, on the extraction of turpentine from the Scotch fir, has been thought worthy of the consideration of the Society, and it will be highly gratifying to me, if it should induce persons who have considerable plantations to try it on such a

scale as to ascertain to what extent it might prove beneficial in this country. The experiment should be tried on trees so situated as to be conveniently examined every day, and the turpentine collected in the hollows removed as often as possible to prevent its being injured, or wasted by the rain. I think, that during the American war, some importations of turpentine were made from Russia and Sweden, and if so, it must have been extracted from what we call the Scotch fir in a colder climate than this. The article called Venice turpentine, which is brought from Carinthia and Carniola, is extracted there from the larch tree; and it might probably answer to try to produce it from the larch trees grown in Great Britain, in the same way as I have collected the turpentine from the Scotch fir. Respecting the wood of the Scotch fir being injured, by the extraction of the turpentine from it, I should rather think that it would, on the contrary, be the better for it; as all those who use deals from Scotch fir, in this neighbourhood, complain that it is too full of turpentine to work well. The fact might be ascertained, by the piece of timber which I sent to the Society, as if it was wished to preserve that part in which the hollow is made, the back part, or nearly half of the tree might be sawn into boards without injury, and those boards might be compared with some from a tree taken down in the winter, from whence the turpentine has not been extracted; it must however be noted, that from the tree I have sent to the Society, the turpentine has only been running one year, whereas, in America, they collect the turpentine from the same tree for three or four succeeding years. It has been supposed and asserted that turpentine was only obtainable from the United States; but I have sufficient documents to prove, if required, that a very large quantity of it can be procured from East Florida; and, I well remember, that
about

about the year 1782, several cargoes of turpentine were shipped in the River St. John's, for Britain; and though that country is at present in the hands of the Spaniards, no doubt, arrangements might be made with the Spanish Government for a supply of that necessary article from thence. It is my earnest wish, that through the medium of the Society of Arts, I may render any information that may be serviceable to the interest of the united Empire, and I will, with pleasure, furnish further communication on the products of Florida and its commerce, if desired by the Society.

I am convinced that tar might be produced from the refuse of firs of English growth to advantage, and that a much better article could be made from them in Britain, than any imported from America. The Scotch firs, in England, from being planted at greater distances from each other than they are naturally found abroad, have much larger knots, and greater numbers of them than in Carolina, or the North of Europe, and would therefore produce more tar, in proportion, from their refuse wood than the trees of those countries.

The pitch-pine of Virginia, the Carolinas, Georgia, and the Floridas, grow to an immense size in what are there called pine-barrens, the soil, of which is finer and whiter than the sand used as writing-sand in Great Britain, and the trees grow almost to the verge of high-water mark on the sea shores. I think it would answer a good purpose for the Society to encourage, by premiums, the extraction of turpentine from British firs.

I remain, Sir,

Your obedient, and very humble Servant,

Bridport Harbour, April 21, 1810.

H. B. WAY.

To C. TAYLOR, M. D. SEC.

J. H. BROWNE, Esq. of Weymouth, certified that he had witnessed the principal experiments made by Mr. Way, in extracting the turpentine from the Scotch firs. That the trees had been planted in 1771 or 1772, and that the wood, subsequent to the operation, had been minutely examined, and found not to be injured by the extraction of the turpentine. He added, that the season was uncommonly wet and unfavorable for the experiment.

*Reference to the Description of Mr. H. B. Way's
Method of procuring Turpentine from Fir Trees.
Pl. 3, Fig. 4.*

a, Represents the lower part of a fir tree, as growing in the earth; *b*, shows the part where a portion of the bark is taken off to assist the emission of the turpentine; *c*, is a hollow cut within the body of the tree, it is in the form of a bason at the lower part to receive the turpentine, which exsudes into it from the pores of the tree: this bason is about six inches from the ground.